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A CLIMATOLOGY OF MONTHLY MEAN SEA SURFACE TEMPERATURES FOR THE --ETC(U)
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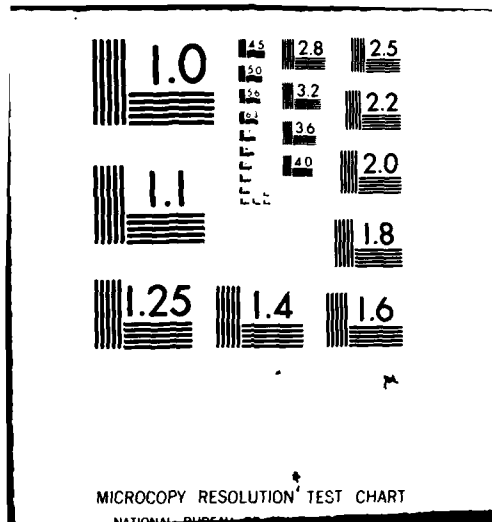
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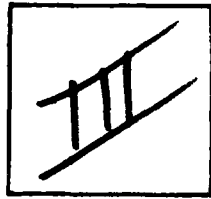
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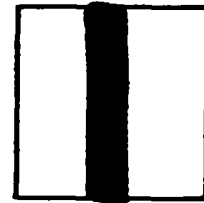
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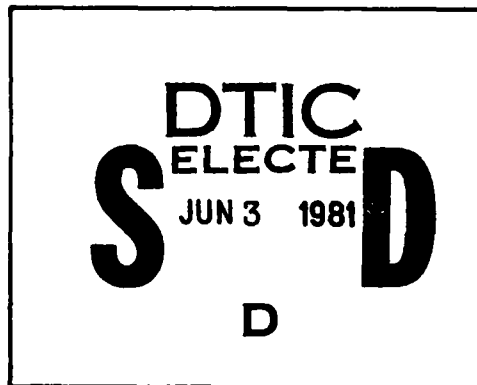
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USAFETAC-PR-78-001

A Climatology of Monthly Mean Sea Surface
Temperatures for the Gulf of Mexico

by

Anthony J. Baltz, SSgt, USAF

January 1978

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report presents monthly mean sea surface temperatures for the Gulf of Mexico in one degree quadrangles. It also includes a short discussion of the temperature data and the ocean currents in the Gulf of Mexico.		

Preface

USAFETAC prepared this report on monthly mean sea-surface temperatures in response to a request from Detachment 9, 12 Weather Squadron, at Tyndall AFB, FL. Detachment 9 is interested in determining the feasibility of forecasting the occurrence of fog and stratus conditions less than 1000 feet and/or three miles, based on monthly mean sea surface temperatures in the Gulf of Mexico. Data were requested in the form of mean monthly values for not greater than one degree quadrangles. A survey of available data revealed that completed reports contained only isothermal analyses with no values plotted for individual quadrangles. The data from the National Climatic Center at Asheville, N.C. were used for this report because they are based on the largest number of observations. These data are also readily usable because the mean values have already been computer calculated and plotted on worksheets.

This report answers a specific request and is not expected to have application beyond that request. Further questions on this problem or related problems should be referred to USAFETAC for consultation and study.

If the requester or any other agency incorporates this report, in whole or in part, into another report, we request that USAFETAC be given proper credit and be furnished a copy of the new report if possible.

A Climatology of Monthly Mean Sea Surface Temperature for the Gulf of Mexico

Introduction

This report presents charts of monthly mean sea-surface temperatures in unanalyzed form for the Gulf of Mexico. The National Climatic Center at Asheville, North Carolina, provided the data in the form of computer produced worksheets which had been used in preparing the U.S. Navy Marine Climatic Atlas of the World, Volume One, North Atlantic Ocean (Dec 1974). Each chart (Figures 1-12) is a Mercator projection covering the area 18°N-31°N and 79°W-98°W. The plotted values represent the mean sea-surface temperature in degrees Celsius and an observation count indicator for the one degree quadrangles in which the temperatures are plotted.

Discussion

This climatology is based on observations taken from commercial and military ships during a period from 1854 to 1973. Each monthly chart represents approximately 85,000 observations. The observation count, which ranges from none in some areas to over 3,000 per one degree quadrangle in heavily traveled shipping lanes, is categorized as follows:

Number of Observations	Category
0-9	A
10-99	B
100-999	C
1000-1999	D
2000-2999	E
>3000	F

The mean temperatures for category A were deleted because less than 10 observations were not considered enough to compute a meaningful average.

According to Rivas (1968) and Saur (1963) the accuracy of the data is controlled by two factors. First, diurnal variations can be as great as 1.2°C for any given location. Second, the accuracy of temperature observations made by commercial and military ships vary in quality.

Sea water temperatures are most commonly read from thermometers located in the sea water intakes in ships' engine rooms. These temperatures are generally known as "injection temperatures." The size, length, and location of the intake pipe and the location of the thermometer in the pipe differ from ship to ship. In some cases, the intake pipes may be located behind overboard discharge pipes; also the ship's load will affect the intake pipe depth. The thermometer may be mounted near the hull or some distance inboard. Incrustation and poor exposure of the thermometer well, combined with coarsely calibrated (sometimes 5°F increments) and incorrectly calibrated thermometers, add to the inaccuracy of observations. Even reporting procedures can cause errors when there is a time lag between recording temperatures on the engine room logs and reporting them on the weather observation.

Other methods of obtaining sea-surface temperatures include bathythermograph observations and bucket observations. The bathythermograph is a recording thermometer for determining both surface and subsurface water temperatures. Bucket observations are made with a thermometer mounted in an insulated container that is dipped into the water. While these temperatures are more precise than injection temperatures, Stevenson (1964) demonstrates that both water and air temperatures are modified in the immediate vicinity of a vessel either anchored or in motion. Rivas (1968) suggests that observational anomalies tend to offset each other when there is a large number of observations taken over a long period of record. However, a U.S. Department of Commerce report (1973) does indicate that daily surface water temperatures may deviate substantially from the means. Some causes of these deviations are hurricane and winter frontal passages, river runoff and ocean currents.

The Loop Current is the primary current in the Gulf of Mexico. Leipper (1970) shows that this current generally follows an annual cycle but it experiences much year to year variability (Figure 13). Its suggested seasonal pattern begins in spring with

a small loop in the southeastern Gulf. The current enters through the Yucatan Strait and curves around Cuba, exiting through the Florida Straits. It penetrates northward in spring, with the rapid northward growth known as the spring intrusion. In summer the current spreads westward with two possible patterns occurring. In one case the entire Loop Current moves westward to the 90°W meridian. In the second case a portion of the loop breaks off from its feeder current and shifts westward. The spreading continues into fall. The loop's intensity weakens such that in winter the primary current is again found in the southeastern Gulf.

Upwelling produces another seasonal effect on Gulf sea-surface temperatures. The only place that significant upwelling occurs is along the northern coast of the Yucatan Peninsula. Upwelling is primarily a summertime phenomena detectable from May through October.

Maul (1976) best describes the entire problem of temperature fluctuations and current variability by suggesting "... the entire ocean is dominated by change with a broad spectrum of temporal and spatial scales. Indeed the mean picture of the oceans - the atlas image - may be largely a figment of our mathematics; one should not expect to encounter mean conditions at any given time."

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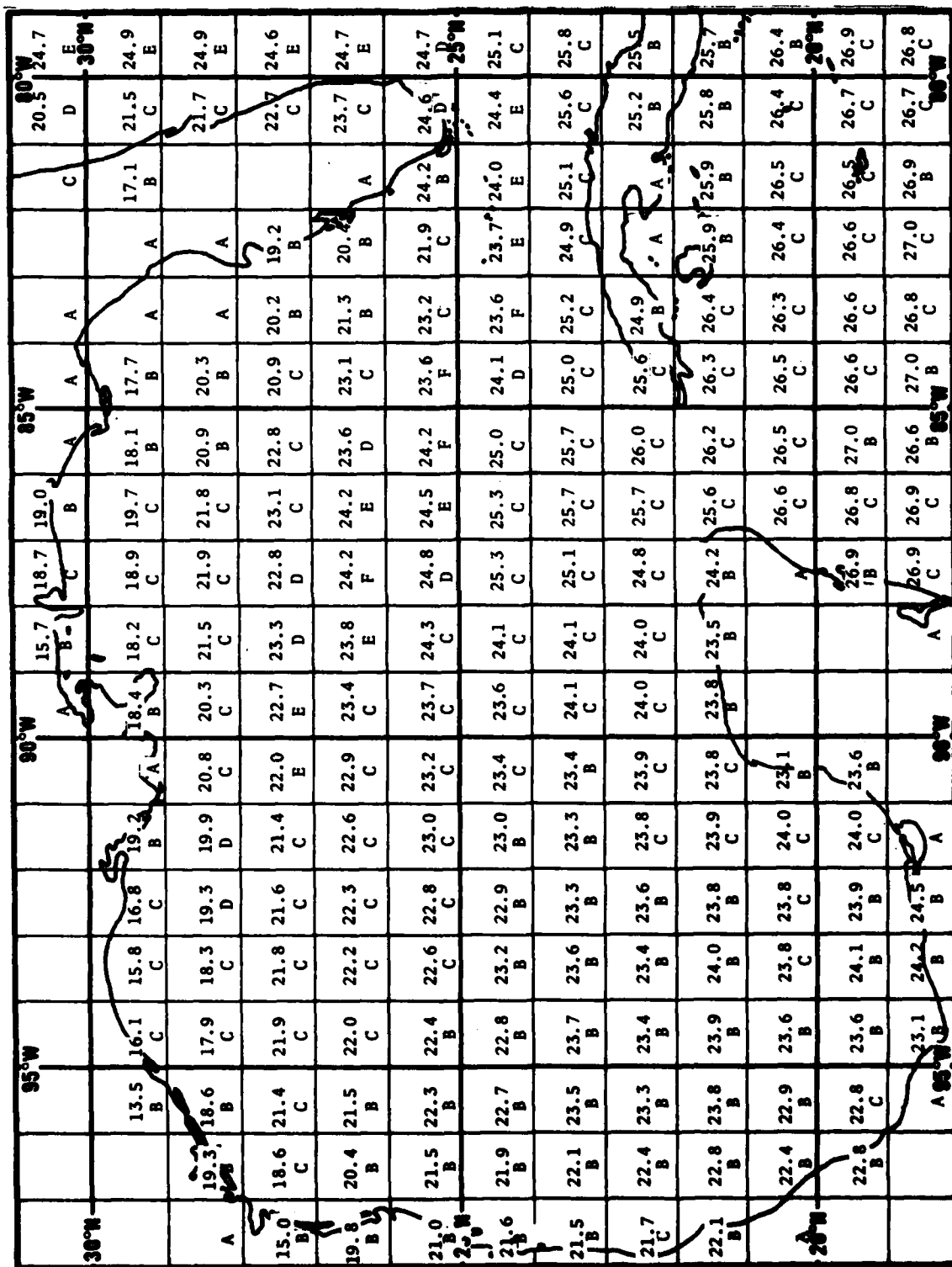


Figure 1. Average Sea Surface Temperatures (Numerical Value) and Observation Count (Letter) for January.

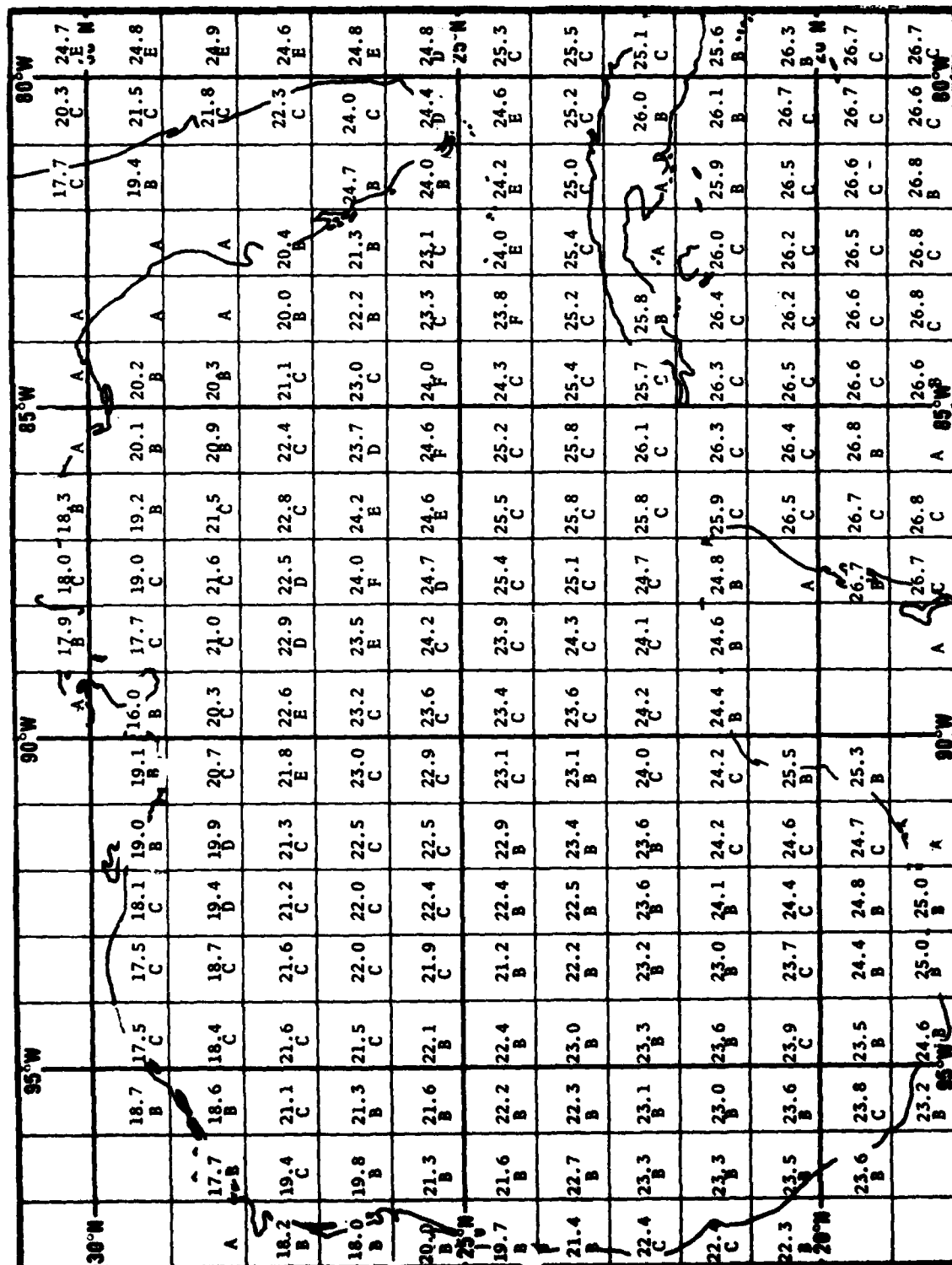


Figure 3. Average Sea Surface Temperatures (Numerical Value) and Observation Count (Letter) for March.

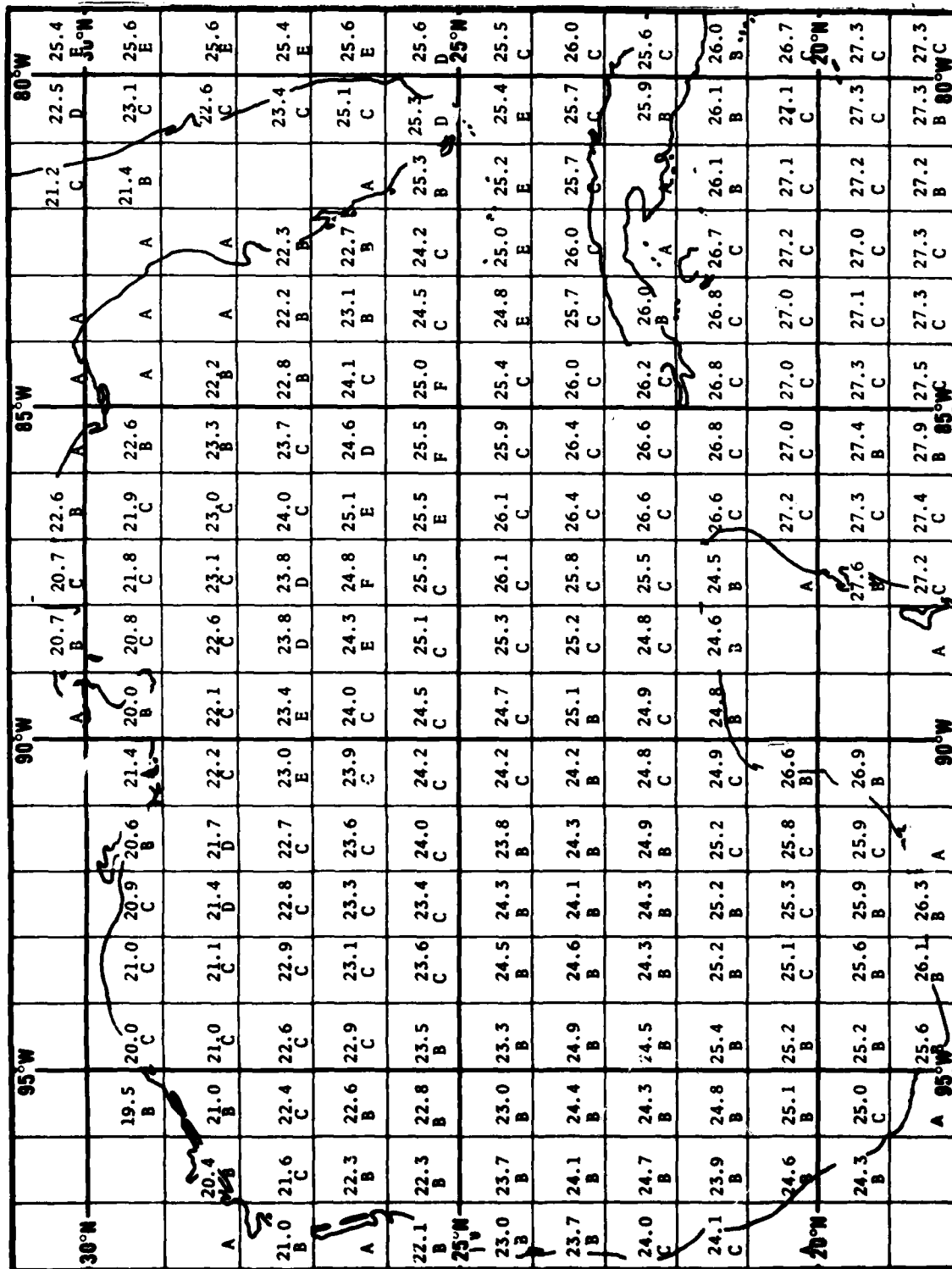
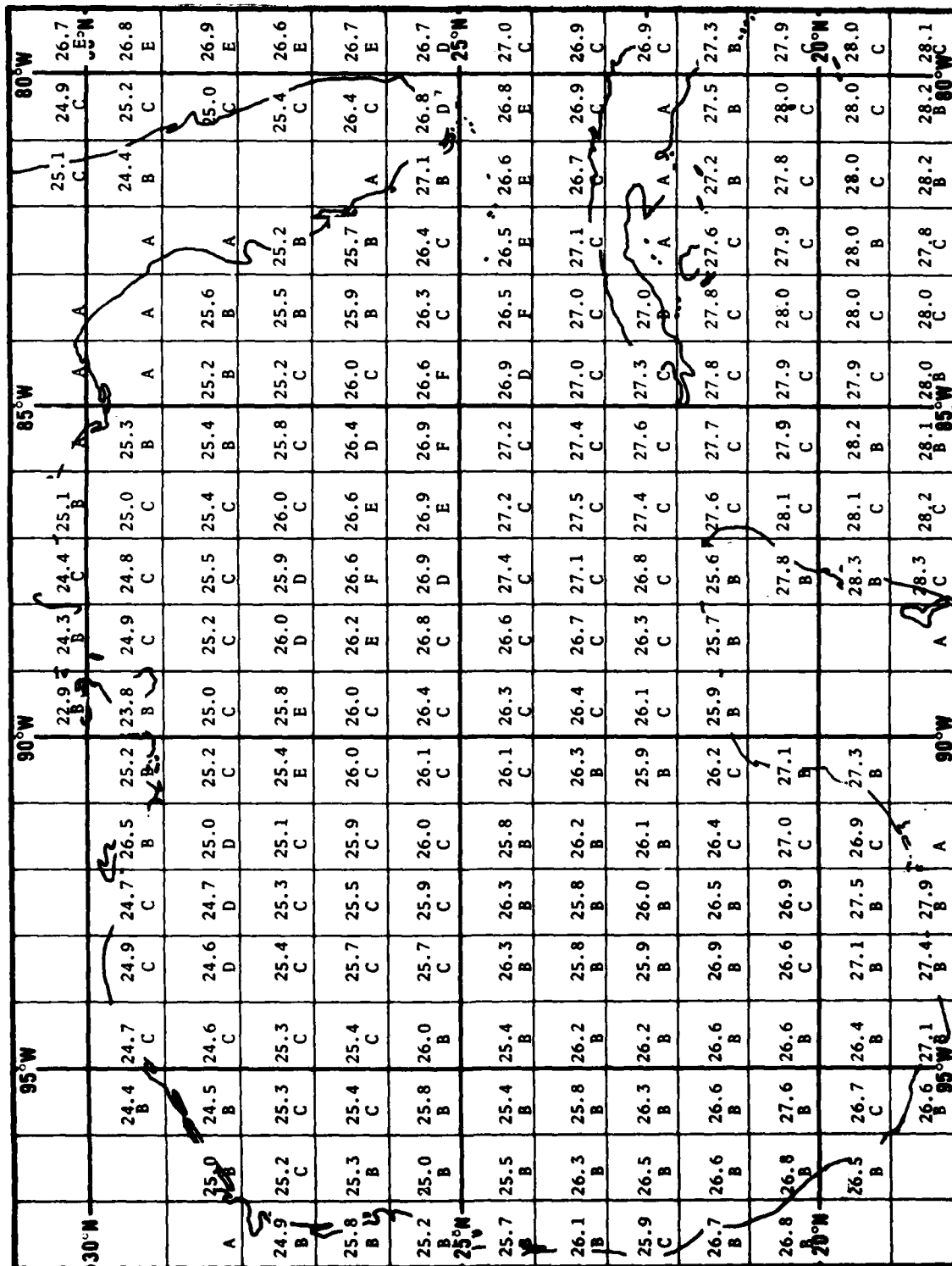


Figure 4. Average Sea Surface Temperatures (Numerical Value) and Observation Count (Letter) for April.



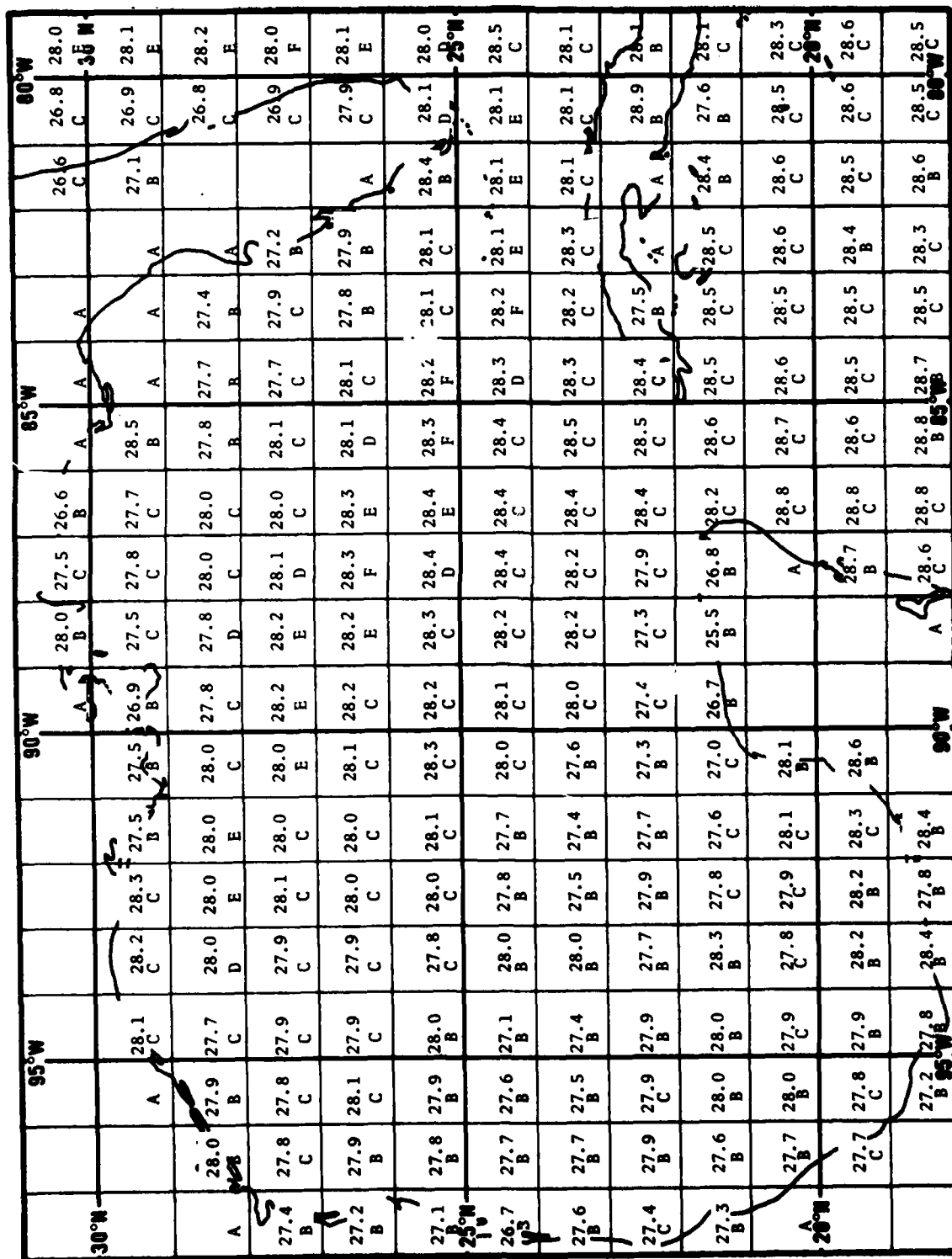
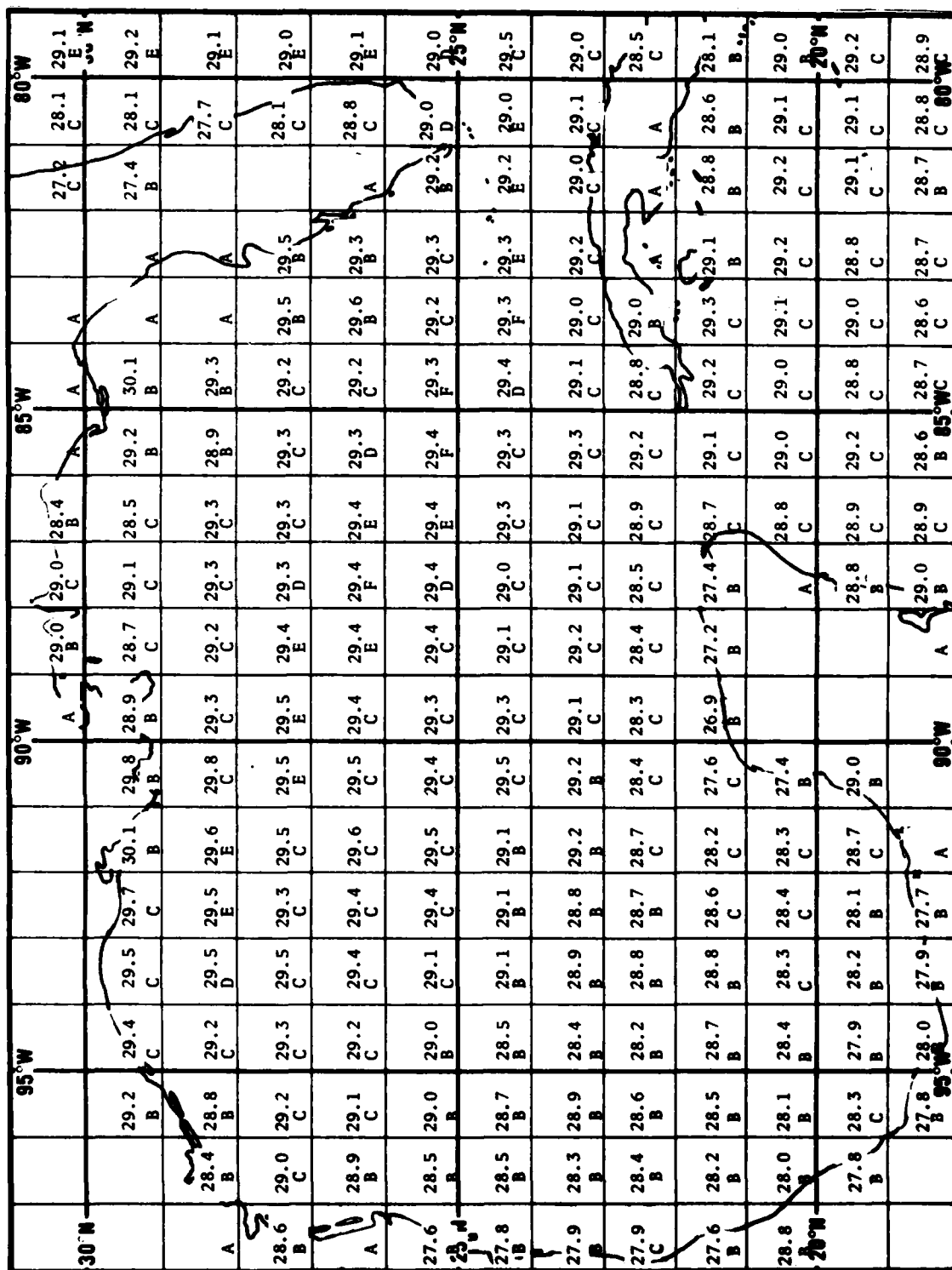
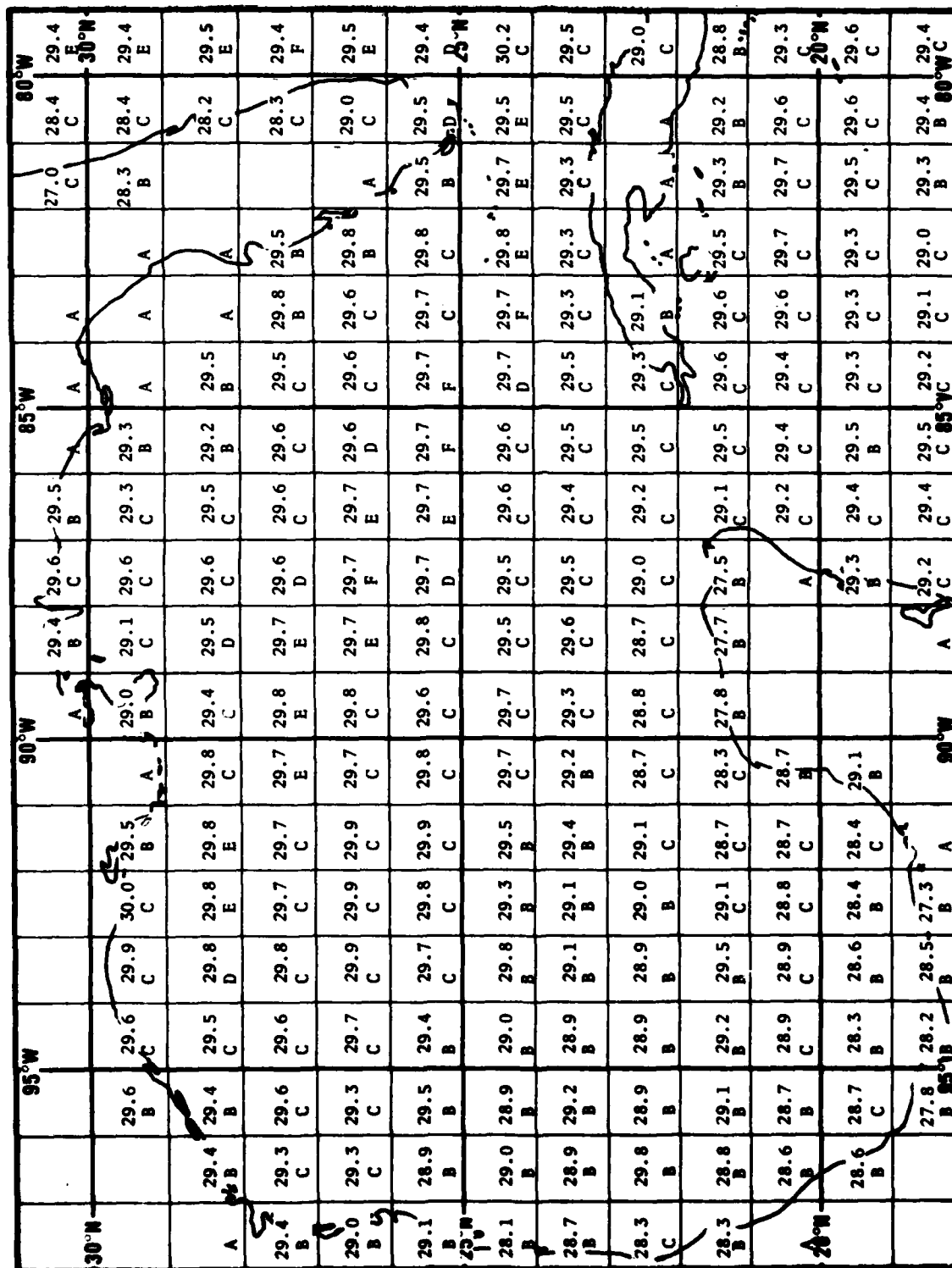


Figure 6. Average Sea Surface Temperatures (Numerical Value) and Observation Count (Letter) for June.





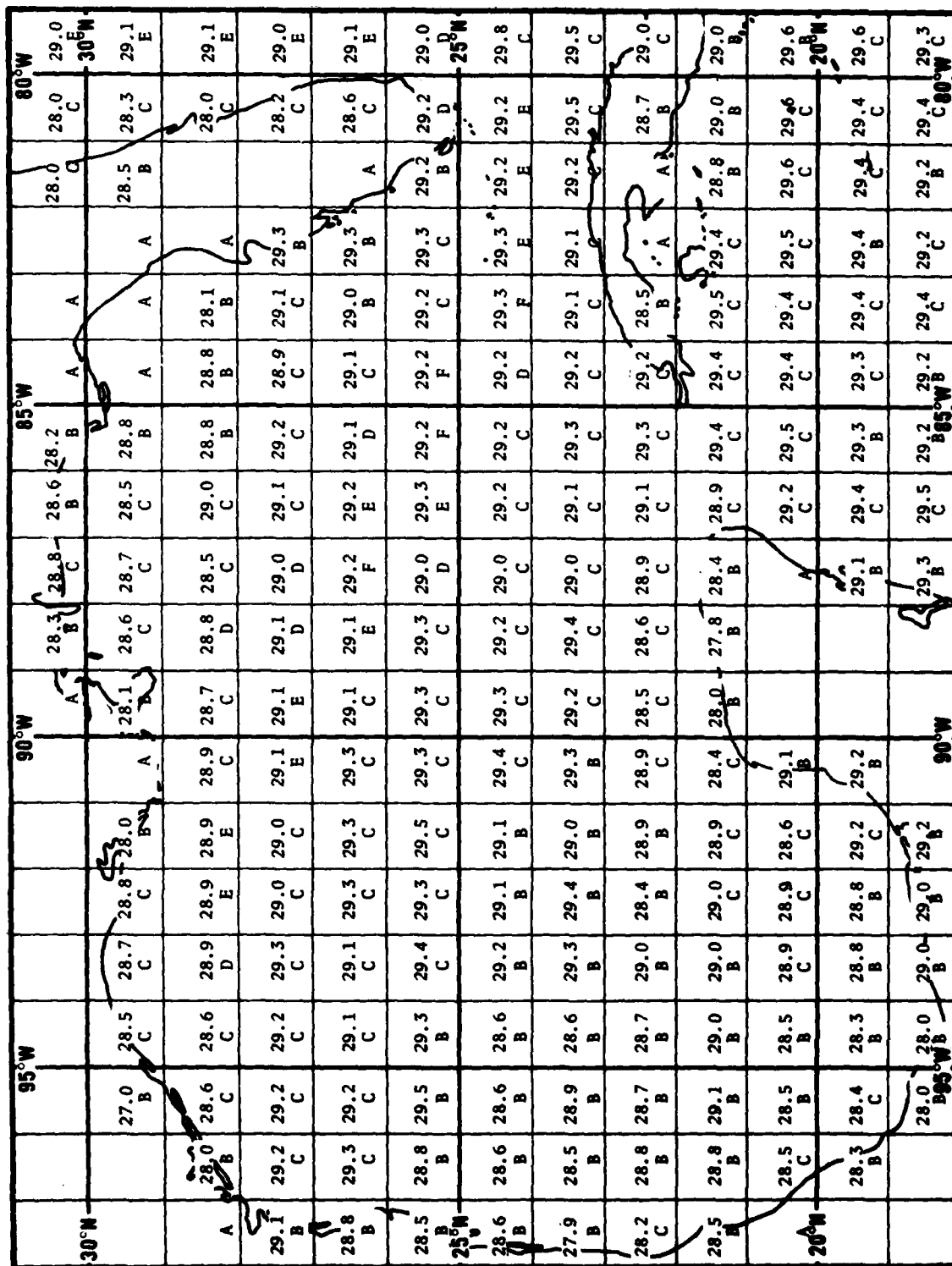


Figure 9. Average Sea Surface Temperatures (Numerical Value) and Observation Count (Letter) for September.

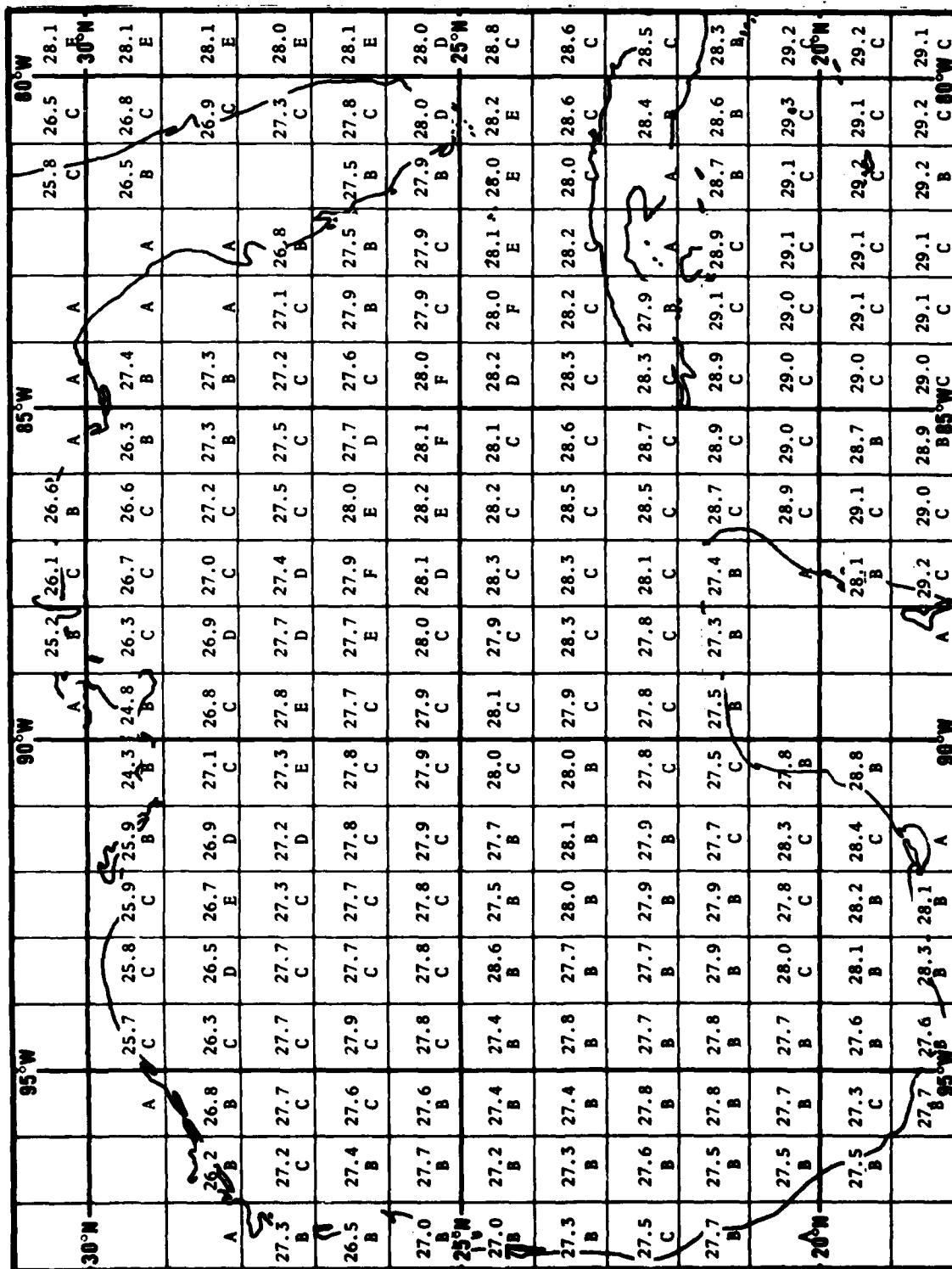
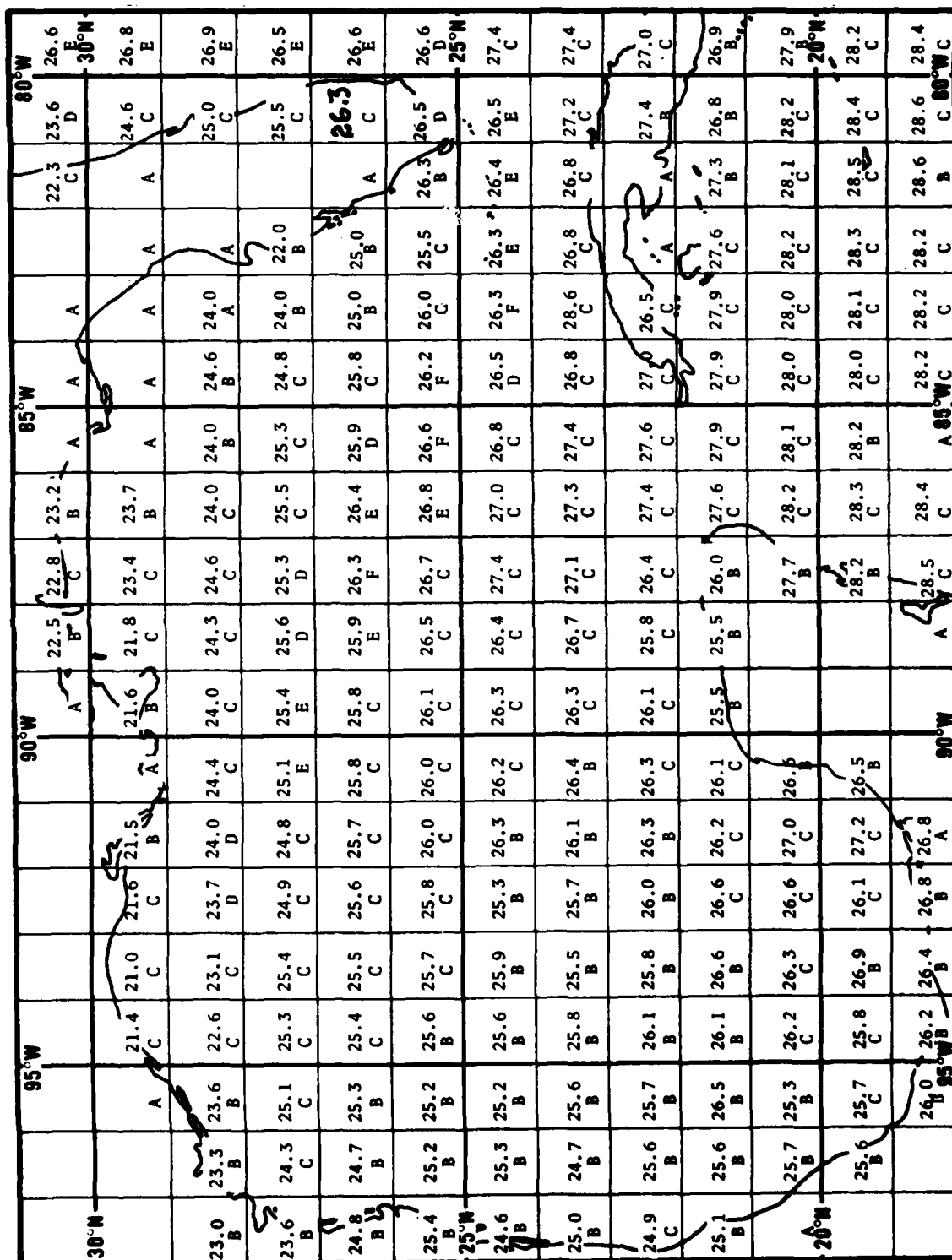


Figure 10. Average Sea Surface Temperatures (Numerical Value) and Observation Count (Letter) for October.



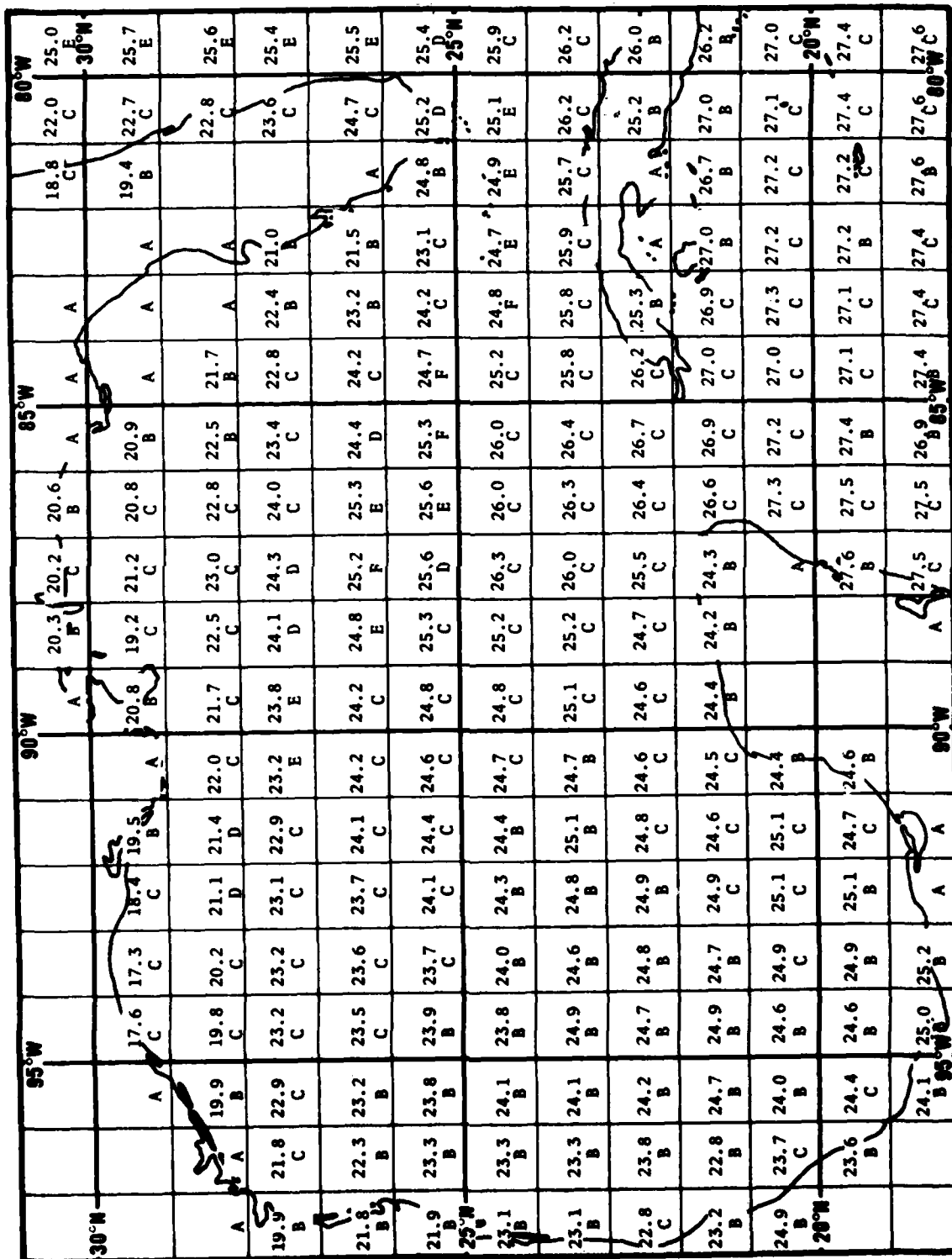


Figure 12. Average Sea Surface Temperatures (Numerical Value) and Observation Count (Letter) for December.

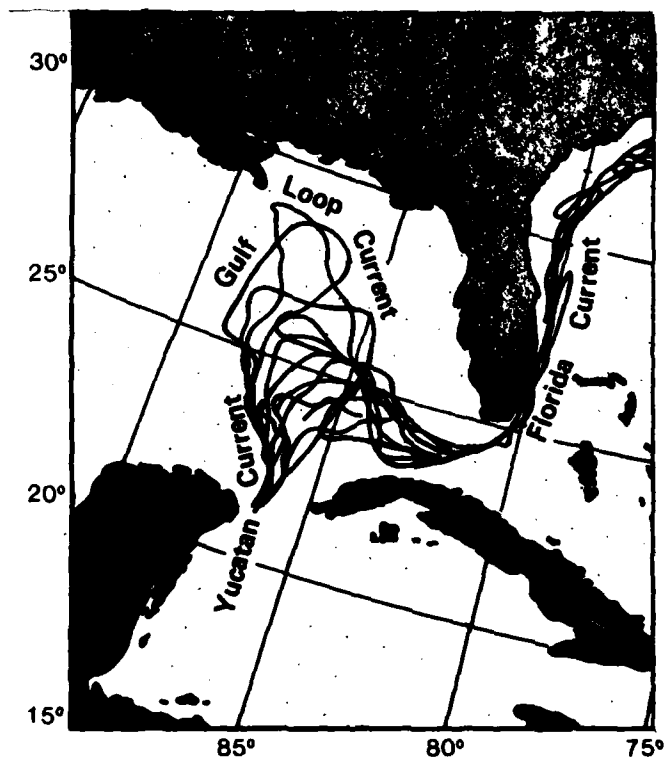


Figure 13. Gulf Loop Current Positions During a Typical Annual Cycle. The Loop Current Intrudes Furthest North Into the Gulf During the Spring of the Year.